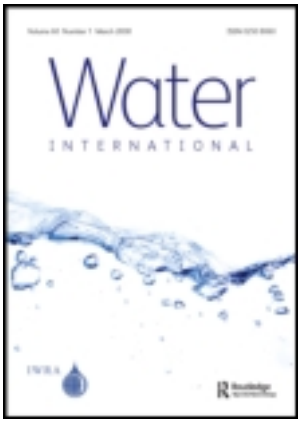

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Urbanizing diseases: contested institutional terrain of water- and vector-borne diseases in Ahmedabad, India

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Ahmedabad represents one of the rapidly urbanizing cities in India, where almost all the households in the region have access to drinking-water supply and sanitation, yet it has not been successful in reducing the threat from water- and vector-borne diseases. This is due to the segregation of the settlements, poor urban planning, inadequate land tenure, and more so the inability of the government to meet the growing demand from the rapidly urbanizing population. Addressing such complex problems requires synergizing sector-wide interventions with a stronger role from the state to address the structural issues plaguing urban societies.

Keywords: urban water; political ecology; public health; institutional integration; urban planning; India

Introduction

Worldwide, water supply and sanitation interventions have taken technocentric and socially engineered solutions. Technocentric solutions (such as on-site drinking water and sanitation, technologies for in-house water treatment or sanitation, vaccination, and drugs and mosquito nets) and socially engineered solutions (through awareness generation and public participation) have been widely promoted to encourage adoption at the individual household level. The technical versus socially engineered solutions conceptualize the human–environment relationship as dichotomous. Such a conceptualization fails to consider the complex interactions between the social and biophysical systems that shape urban forms of water management.

Increasing urban population, rapid economic growth, poor urban water management, highly diverse water use, inadequate financing, dwindling sources of freshwater, poor and ageing infrastructure, intermittent water supply (including quality) and low water tariffs have combined to make the management of urban water a complex terrain. Water is "a brutal delineator of social power which has at some times worked to either foster greater urban cohesion or generate new forms of political conflict" (Gandy, 2004, p. 363). Swyngedouw (1997) argued that water is embedded in the political ecology of power through which the urbanization process unfolds. By exploring the history of urbanization in Guayaquil, Ecuador, Swyngedouw (1997) demonstrated how access to water has been an intense struggle among urban residents. Examining the water infrastructure in Mumbai, Gandy (2008) argued that the water and sanitation crisis facing the city needs to be understood in relation to the peculiarities of capitalist urbanization and state formation in an Indian context.

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Chaplin (2011) took this further by elaborating that environmental problems confronting Indian cities are a result of the legacy of the colonial city, which is characterized by segregation of settlements, leading to inequitable access to drinking water and sanitation, inadequate funding and failure of the state to manage urban growth. This is further exploited by post-colonial actors who use public funds to provide private goods (Chaplin, 2011). Building on the works of Swyngedouw (1997), Gandy (2004, 2008), Putri and Rahmanti (2010) and Chaplin (2011) on political ecology, this paper examines the historical and contemporary role of diverse institutions of urban water infrastructure in influencing the spatial spread of water- and vector-borne diseases in Ahmedabad City, India.

Ahmedabad represents one of the rapidly urbanizing economies in India, where almost all the households in the region have access to drinking-water supply and sanitation, yet this fact has not reduced the threat from water- and vector-borne diseases. The spatial distribution of water- and vector-borne diseases, discussed in the second section, reveals the prevalence of water-borne diseases in the highly dense and slum-dotted areas, while vector-borne diseases cross this border. The third section examines the contested institutional environment surrounding urban water management that has failed to protect the public health, especially among the urban poor. Given the complexity of the problem, various urban governance institutions and their actors maintain a "veil" of ignorance by exploiting the democratic governance arrangements to maintain power and authority, at least until a disaster strikes. The final section argues that in this complex and contested institutional terrain, solutions to the growing threat of disease cannot be simplified to technocentric or socially engineered solutions (Putri & Rahmanti, 2010). Complex problems require complex solutions, which have to come from diverse sectors working with each other in addressing urban public health.

Urban health in Ahmedabad: diseases without borders?

Water- and vector-borne diseases have ravaged Ahmedabad in the past. One of the earliest known crises was between 1880 and 1884, when about 28,139 died in the city; malarial fever was said to be the cause (Yagnik & Sheth, 2011). Ranchodlal Chhotalal, then president of the municipal corporation, identified the defective water supply and ineffective sewerage system as the cause of the deaths (Yagnik & Sheth, 2011). However, the mid-twentieth century witnessed an increased number of epidemics from new diseases. Since 1976, seven outbreaks of jaundice (in 1976, 1982, 1984, 1986, 1987, 2004 and 2008) have been reported in the city (Chauhan et al., 2010; Khan et al., 2006). In the last few decades there have also been recurrences of chikungunya and dengue. In 2005, a suspected outbreak of dengue was reported in the city (National Institute of Virology, 2006), and in 2011, the media reported a high number of cases in the city (ToI, 2011). Furthermore, the high mortality rate between August and November 2006 was associated with a chikungunya epidemic in India (Mavalankar et al., 2008). These increasing cases and outbreaks only call for re-examining the urbanization process in the city.

Ahmedabad city came into existence in January 1857 and was recognized as a municipality in 1873. After independence, it was given the status of municipal corporation. As of 2011, the Ahmedabad Municipal Corporation (AMC) was spread over 466 km^2, with a population of about 5.6 million (UMC, 2012). The city is currently divided into 64 administrative wards, distributed across six administrative zones – North, South, East, West, New West and Central. Geographically, the city is divided by the river Sabarmati into eastern and western regions. The eastern part contains the walled city (considered to be oldest part of the city), the industrial area, the railway station, and

services catering to the low-income settlements that fall within the Central, East, South and North Zones. The western part has upper-class and upper-middle-class residential areas and educational institutions, is less congested, better serviced, more spacious and more affluent, and is primarily in the West and New West Zones.

The overall population of the city increased from a mere 185,000 in 1901 to about 5.6 million in 2011 (UMC, 2012). Between 1981 and 2011 alone, the population more than doubled. The growth has mainly been in the New West, South, North and in the East Zone, probably people migrating out from the old part of the city (UMC, 2012). The increase has been fuelled by natural growth as well as an increase in the jurisdictional area of the city from 190 km^2 to 466 km^2 during 2001–2011. The rapid growth of the population has also triggered the growth of urban slums; by 2011, one in two people was living in the slums. The slums tend to concentrate in South, East, Central, and New West Zones, which constitute 80% of the total slum population in the city (Figure 1). The New West is a newly included zone, where many of the villages have unclear tenure status, therefore they have been classified as "slums", which is probably the reason for the higher percentage of slums.

In this rapidly urbanizing region, the AMC has been able to supply an average of around 148 lcd (litres per capita per day) to about 88% of its population, with daily supply at the consumer end being 2.25 hours at a fixed time (UMC, 2012). In terms of its coverage, the city was ranked 19th at the national level, and compared to the other megacities in the country it was third in the 2009 national sanitation ranking (UMC, 2012). In spite of the coverage, the occurrence of water- and vector-borne diseases in Ahmedabad from 2010 to 2012 follows an inconsistent trend (Table 1). Among the water-borne diseases, cases of gastroenteritis and cholera decreased from 2010 to 2011 and increased in 2012. In contrast, cases of jaundice and typhoid increased from 2010 to 2011 and decreased in 2012. With regard to vector-borne diseases, malaria cases increased from 2010 to 2012, while dengue cases decreased during the same period. Overall between 2010 and 2012, malaria (both P. *vivax* and P. *Falciparum*) cases increased more than 100 per cent, while jaundice (indoor) and Typhoid have also shown an increase of 90 and 60 per cent respectively.

Incidence rates from 2010 to 2012 also show varying trends (Figure 2). The incidence of gastroenteritis decreased from 144 (per 100,000) in 2010 to 80 in 2011, but increased to

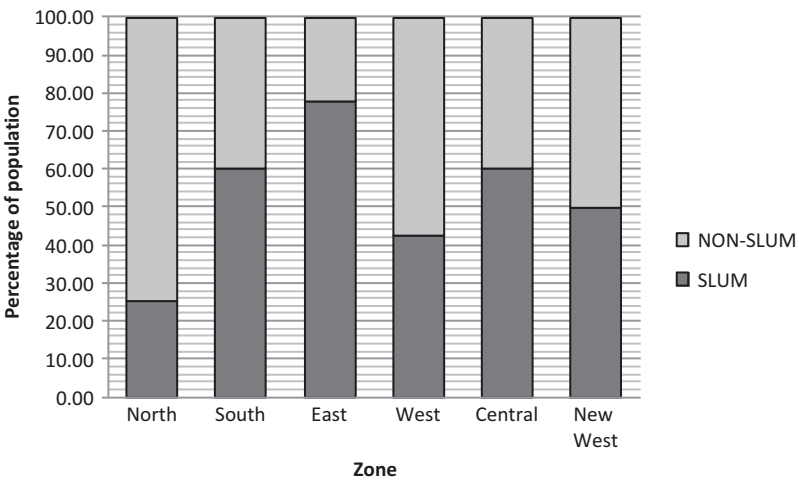

Figure 1. Distribution of slum and non-slum population by zone in Ahmedabad, 2011.

Source: UMC (2012).

Table 1. Reported cases of water- and vector-borne diseases in Ahmedabad City.

	2010	2011	2012	Change from 2010 to 2012 (%)
Water-borne diseases				
Gastroenteritis	7,673	4,472	5,557	−27.58
Jaundice (outpatient data)	1,855	3,553	1,759	−5.18
Jaundice (indoor)	1,236	3,247	2,396	+93.85
Typhoid	778	1,355	1,239	+59.25
Cholera	165	57	126	−23.64
Vector-borne diseases				
Malaria (*P. vivax*)	3,342	5,893	10,068	+201.26
Malaria (*P. falciparum*)	639	1,265	1,314	+105.63
Malaria	3,981	7,158	11,382	+185.91
Dengue	694	673	451	−35.01

Source: compiled from the statistics unit in the Department of Infectious Diseases and Epidemic Division; AMC (2012).

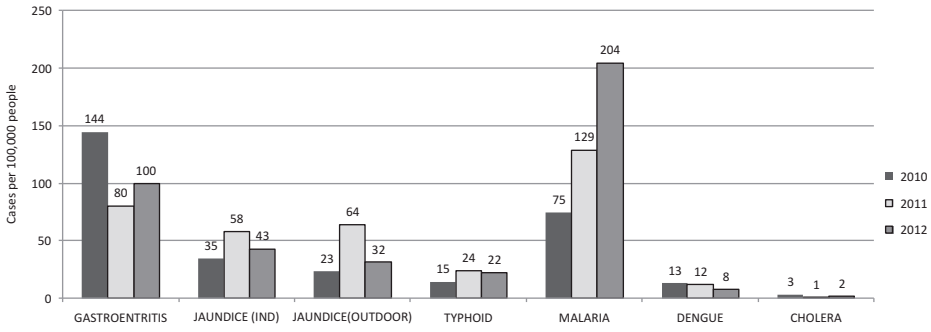

Figure 2. Incidence rates of water- and vector-borne diseases in Ahmedabad (2010 to 2012).

Source: compiled from the statistics unit in the Department of Infectious Diseases and Epidemic Division; AMC (2012).

100 in 2012. Between 2010 and 2011, the incidence of jaundice and typhoid increased and decreased in 2012, but still remained higher than in 2010. The incidence of malaria nearly tripled between 2010 and 2012. The incidence of cholera decreased in 2011, but showed a marginal increase in 2012. Only dengue decreased continuously.

The diseases are widely prevalent throughout the year, except for cholera. The monthly distribution of the disease for the year 2012 reveals higher rates during the monsoonal period (June to September) (Figure 3a). Water-borne diseases tend to increase from the month of April and decrease after September. During the year, as the incidence rates of water-borne diseases recede (Figure 3b), the vector-borne diseases tend to pick up. Interestingly, dengue reported a constant trend, without any influence from the climatic factor; but this could be due to the low occurrence rate.

The incidence rates of water-borne diseases tend to have a high positive correlation with the percentage of slum population and population density in the 64 administrative wards in 2011 and 2012 (Table 2). On the other hand, vector-borne diseases (malaria and dengue) do not reveal any significant correlation with slum population and density. In fact, a negative relationship is notable between malaria and density of population for both

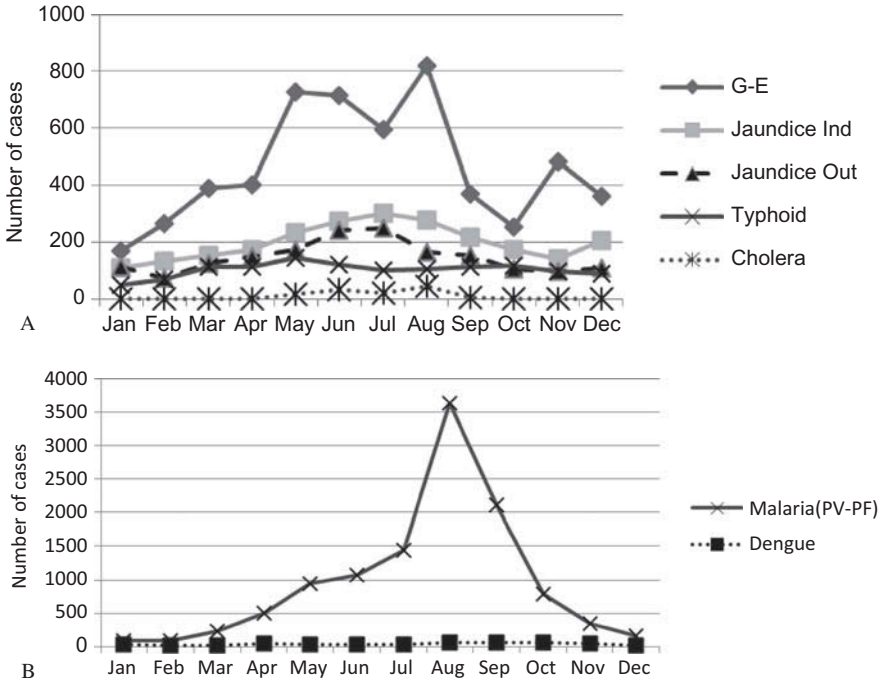

Figure 3. Monthly incidence of (a) water-borne diseases, (b) vector-borne diseases, in 2012.

Source: compiled from the statistics unit in the Department of Infectious Diseases and Epidemic Division; AMC (2012).

Table 2. Correlations between slums and density of population, 2011–2012.

	Slum population		Density of population	
Diseases	2011	2012	2011	2012
Gastroenteritis	0.460**	0.508**	0.429**	0.424**
Jaundice (indoor)	0.430**	0.465**	0.508**	0.389**
Jaundice (outdoor)	0.155	0.162	0.253	0.216
Typhoid	0.356**	0.435**	0.376**	0.389**
Cholera	0.309*	0.394**	0.062	0.302*
Malaria (positive cases of PV and PF)	0.259	0.323*	−0.021	−0.015
Dengue	0.294*	−0.153	0.029	0.031

Note: Spearman's correlation coefficient: **2-tailed significance; *1-tailed significance.

years. The spatial distribution of disease in the city reveals a concentration of both water- and vector-borne diseases in the oldest part of the city, which has a higher concentration of both small-scale industries and lower-class informal settlements. While the oldest part of the city remains an incubator for various diseases, the middle- and upper-class residents living in the western part of the city are not left out, as vector-borne diseases are spreading their tentacles to other parts of the city. These middle- and upper-class residents might be receiving good water supply and have adequate sanitation; however, their environment is

not hygienic enough (due to the lack of civic amenities, waterlogging and inadequate disposal of solid waste) to prevent breeding of vectors (Hemington & Qureshi, 2012). Also, many malarial patients discontinue medication as soon as their fever subsides, putting others at risk (because malarial virus is still present in the patient's body) (ToI, 2012).

Complexity of urban health in Ahmedabad city

The urban health in the city is influenced by the segregation of the settlements, poor urban planning, inadequate land tenure, and more so the inability of the government to meet the growing demand from the rapidly urbanizing population. Ahmedabad was one of the illustrious cities during the Mughal period, from the fifteenth to the seventeenth centuries, when textiles contributed significantly to the city's economy. The textile producers were divided into many groups based on caste and religion, but connected through a sequence of operations that was well established (Yagnik & Sheth, 2011). The colonial period, in the nineteenth and early twentieth centuries, transformed this decentralized caste-based activity into centralized caste-based tasks in the mills, which led to domination by two groups, the skilled millworkers from higher-caste Hindus and Muslims living within the walled city, and the labour-intensive, low-paid workers who were dominated by Muslims and the lower peasant class from Hindus living on the outskirts of the walled city, also called the industrial area. This division in settlements shaped the urban space in the city. The walled city had two clusters of settlements, one each for Hindus and Muslims. The former were living in caste-defined clusters known as *pol*s, and the latter in *mohalla*s (Chandhoke, 2009). The industrial area consisted of textile mills and workers living in group-housing units called *chawl*s or c*hali*s. Built by the textile owners to accommodate workers at low cost many times near the textile mills, *chali*s consisted of one-room housing with common toilets and were considered hovels of the worst quality, with no water supply and filthy toilets (Yagnik & Sheth, 2011). These settlements lacked clear tenancy rights to sell or improve their housing, and therefore workers could not move out; in official records, such settlements are often described as "illegal" and classified as slums.

The colonial legacy of urban planning continued the segregation of settlements that created the foundation for urban slums and poor urban water infrastructure. With neoliberal policies in the 1980s and systematic confirmation by the new economic policy in 1991, there were significant changes in the textile industries, which mostly affected the people living in the eastern part of the city. This had three implications for urban water management. First, the closure of textile mills caused the loss of formal employment by the vast majority of sacked workers (Breman, 2001). In addition to these direct victims, petty traders, services and the transport sector in the mill segment suffered a drastic loss of income. It is estimated that about one-sixth of the city's 3.3 million inhabitants (in 1991) were directly or indirectly affected by the closure of the textile industry (Breman, 2004). This displacement increased squatter settling, worsened the living conditions of the families and caused the loss of cheap or free medical care (Breman, 2004). The second factor is the unclear land tenure of these lower-class and lower-middle-class workers and their families living in *chalis*. Workers residing in the *chali*s were unable to sell those rights in the open market and therefore could not move out of their housing. Finally, the neoliberal policies affecting the textile industries accentuated the ghettoization process in the city whereby certain population groups were restricted or confined to particular areas. Though the process of ghettoization began in 1960s with Hindu–Muslim riots, it became

accelerated, most prominently during the 2002 riots (Breman, 2004). Today, the city, once characterized by varying patterns of residential ordering, is almost divided into Hindu- and Muslim-inhabited areas (Chandhoke, 2009). The wide disparity in settlement patterns has also resulted in uneven access to drinking water and sanitation in the city.

In spite of housing strategy being high on the national agenda in various policies, slums in India have been ignored or discriminated against by urban planners and policy makers. During the first few decades of India's independence, the government's approach favoured "slum-free" cities, marked by large-scale evictions and demolitions accompanied by resettlement and, at a later stage, rehabilitation (Anand, 2008). This became unsustainable, because resettlement often meant separating the urban poor from their only means of livelihood. The failure of these approaches led to the revival of urban housing in the 1970s towards a new vision of "slum improvement" (e.g. the "sites and services" scheme, the Environmental Improvement of Urban Slums programme and the National Slum Development Programme) that reflected the integral nature of slums in the economy of the cities (Anand, 2008). Keeping in mind the past failures, the AMC has a few initiatives for slum development (Mahadevia, 2010). These are: (1) the 90:10 scheme, in which the AMC contributes 90% of the cost of household water connection and toilet construction; (2) a "no-objection certificate" given by the AMC to slum inhabitants, allowing individual water-supply and sewerage connections; and (3) the Slum Networking Programme. However, insecure land tenure remains one of the major hurdles in improving slums in the cities (Anand, 2008). Land-use planning for tenure-secured land is an important component of urban planning. India's urban planning inherited from its colonial past rarely conceived the city in indigenous terms that recognized the culturally plural, socially evolving and economically constrained characteristics of Indian society (Menon, 1997).

Urban water management: a bucket with holes?

Water supply and sanitation occupied a core part of the city's development in the nineteenth century. The credit for these developments goes to a strong coalition of local leaders representing the city's economic, social, political and industrial interests (Chaplin, 2011). Interestingly, it is these same groups that spar today in mismanaging existing urban water. The AMC started sourcing water from the river Narmada in 2000 due to the inability of existing surface water and groundwater to meet the growing demand. With this new source, the city has a capacity of 1850 million litres per day (Mld) and a treatment capacity of 1620 Mld. Of total treatment capacity, the city actually treats 950 Mld, against a demand of 835 Mld (UMC, 2012). The treated water is distributed through 143 distribution stations, which supply water to about 5.5 million urban residences. The average daily supply of water is around 1030 Mld, with average use estimated to be around 148 lcd (UMC, 2012).

The inadequate urban planning has given opportunities for different sections of the population (the poor, middle-class and upper-class households) to access drinking water and sanitation through different strategies. Given their exclusion from the city, the poor use agents (city councillors, local leaders, plumbers and social workers) to acquire legal or illegal connections, or even drill boreholes or dig wells to access water, with or without the knowledge of the government bureaucrats. In terms of sanitation, they tend to either build toilets with open discharge, use public toilets, or opt for open defecation. The poor, residing largely in the walled city and in the industrial areas, are often low-skilled workers with insecure land tenure and "homes" of ad hoc construction. They constitute about half

(52% in 2011) of the population in the city (UMC, 2012). As the city expands, lower-middle-class and upper-middle-class households strategize about how to own a house in the urban fringe areas. Often, these lands are illegal, "built in ignorance or in violation of master plans and land use regulations" (Chaplin, 2011, p. 83). Furthermore, it takes about a decade to get city master plans and town plans approved, giving ample time to construct houses illegally through agents. Wealthy households engage in a variety of "opt-out" strategies by installing pumps or calling for water tankers and purification devices within the city (Gandy, 2004). They seek open spaces in the urban fringes to construct "farm houses", many of which violate urban-planning regulations. Given these divergent interests and capacities, there is high disparity in access to drinking water. About 63% of households consider the water supply inadequate (Table 3) (Shaban & Sharma, 2007). Shaban and Sharma showed that the average per capita water consumption was about 95 lcd, with about 40% of the population receiving less than 75 lcd. Over 86% of the slum households and about 70% of the low-income group reported receiving less than 100 lcd of water.

The responsibility for urban water supply and sanitation in the city rests with the Department of Engineering (DoE). Although the city receives a significant proportion of funding for capital investments from the central government, the financing of operation and maintenance (O&M) is the responsibility of the DoE. There is no private involvement in this sector. It is estimated that the AMC spends INR 167 per capita (USD 2.54),[1] which is only about 24% of the norm under the national guidelines to be spent for drinking water and sanitation. Under-spending on O&M has severe implications for urban water and sanitation, as it results in reduced life of the asset and unsafe services (CEPT, 2011). The problem is compounded with inadequate (only 64%) recovery through local taxes and water charges. As there is no metering or volumetric tariff, a water tax (about 30% of the total property tax) is generally collected along with property tax or a special tax levied per water connection. In the city, it takes one to two weeks to get a water connection due to bureaucratic paperwork. Alternatively, people use their social network to get connections directly from the drinking-water pipelines for a cost ranging from INR 3000 to INR 6000 per connection (USD 45 to USD 90). Limited human resource capacity (it is estimated that municipal corporations in Gujarat State have only 50% to 60% of the approved staff, with many of them working as day labourers) further hampers the efficient delivery of water (CEPT, 2011). During field research, the research team witnessed the city's junior engineers overwhelmed by their workloads. They receive calls constantly on their mobile. While a large number of the calls are from people reporting various water infrastructure–related problems, calls also come regularly from local power brokers asking for leaks to be plugged or water connections provided (outside the formal system); there are also

Table 3. Percentage of water-deficient households in different income-groups of Ahmedabad.

Type of settlement	Households consuming less than 100 lcd of water (%)
High-income group	42.5
Middle-income group	56.3
Low-income group	69.2
Slum settlements	86.1
Mixed areas	57.8
All	62.0

Source: Shaban and Sharma (2007).

calls from government officials and others. Given the low cost recovery, inadequate funding, and poor human resource capacity, the city's water infrastructure faces inefficiencies in the distribution of water, poor design of water networks, physical water losses, illegal connections and unduly high electric consumption. These are well concealed collectively by the government institutions and political bodies to avoid revealing the inefficiency. "To collectively know what not to know" – the power of ignorance (Anand, 2009, p. 17) helps these officials maintain the status quo of urban water infrastructure.

The power of ignorance: who will bell the cat?

The power of ignorance is central to the authority and power of the engineers, politicians, and public and private companies who actively gain by maintaining the status quo of the urban water infrastructure. During the field research, a junior engineer stated that the problem of water in the city is due not to a shortage of water but to the mixing of drinking and sewerage water between the water-pumping station and the consumer. Though this statement subtly refers to technical problems, it opens up a "Pandora's box" with respect to the socio-politics of water infrastructure.

Poor urban planning and insecure land tenure for the majority of urban dwellers has led to large-scale grabbing of land (and water) from the public and private spaces in close connection with politicians and bureaucrats. Though the DoE (which oversees the real estate unit) is well aware of these land grabs, because they also collect tax on encroached land, there is rarely any documented evidence (at least not that was shared with the research team) on the scale of the encroachments. Encroachment is so stark that road widths have been reduced, inhibiting the city engineers' efforts to re-lay 50-plus-year-old pipes or even attend to the regular maintenance and operation of water infrastructure. What is even more dangerous is that many of the households are actually living on top of sewerage lines. Some of these households are affected by the release of poisonous gas (probably methane or other toxic gas) from the sewerage lines, leading to death (ToI, 2013). While the DoE and the Health Department are highly concerned with the gravity of the problem (because they are fired in any reported case of accident or disaster), as one of the junior engineers from the Central Zone pointed out, given that the land and water grabbing exists and "given the strong nexus between politicians, our bureaucrats and the urban poor, it is impossible for us to act alone". In turn, the DoE has followed a "quick-fix" approach to replacing some of the pipelines since 1997, maintained one junior engineer.

Land grabbing, inadequate information, and that "quick-fix" approach have led to the draining of urban water. Increasing illegal connections, old infrastructure and poor alignment of the networks increase the chances of water leakage. The AMC estimates a system loss of about 20% to 25% during transmission and distribution, but it could certainly be more. Shaban and Sharma (2007) estimate the leakage to be around 40% and 60% in Indian cities. Leakages of water increase the chances, especially with rainwater and polluted waters, of mixing between drinking and sewage waters. Close observation during field research revealed chaotic alignment of pipes, which aggravates mixing. The junior engineer said that the distance between the drinking-water and sewerage pipelines should be less than 1 foot but many of them (especially the tertiary pipelines) are less than 1 foot apart, with one above or below the other. The close spacing of these pipelines has severe consequences for public health. The drinking-water pipelines have low pressure most of the day, as the water is supplied for only two hours per day. By comparison, the sewerage

lines are overflowing throughout the day. All these pipelines have rubber joints, irrespective of the pipe material. The rubber material connecting the pipes expands and contracts with temperature, opening space for leakage. Because of the close proximity of the pipelines, the high water pressure from the sewerage networks easily enters the nearly empty drinking-water pipes. Mixing increases when the pipes are old, when rain causes waterlogging, when pipelines are tampered with during illegal connection, when residents use pumps to increase the water pressure, and when domestic or industrial wastewater is disposed of in open areas.

Neglected health care provision

Health care in the city depends upon its urban infrastructure, such as water supply and sanitation. To maintain health standards, the Health Department must work in coordination with other departments, especially the DoE. Unfortunately, health care does not form part of urban planning, and is even overlooked by other departments. On 24 January 2013, during a workshop called "Urbanization, Water Management and Human Health in Ahmedabad", where both DoE and Health Department officials were invited, Dr Vijay Kohli, deputy medical officer in the Health Department of the AMC, recognized that this was the "first gathering where health department and city engineer were jointly discussing urban health issues. In the past whenever there was an outbreak of water- and vector-borne diseases the department of health officials were called, but never involved the officials from the department of city engineering" (cited in Saravanan, 2013, p. 15). He reaffirmed the importance of working together for ensuring the well-being of urban health. Health departments are often considered tail-enders within urban governance; they are called only when there is an outbreak or a health crisis, and rarely consulted during the urban planning process.

There is limited engagement between the Health Department and the DoE. The DoE regularly chlorinates the water before distribution; however, when an outbreak is noticed by the Health Department, it informs the DoE to chlorinate additionally if required. It simultaneously informs the Conservancy Department (which is part of the Health Department) to ensure efficient solid waste management. By improving the quality of the water supply and improving sanitation facilities, the engineering and sanitation departments can control the outbreaks of various diseases. Often this sort of interaction leads to the Health Department complaining to the engineers, and vice versa. This conflict in turn leads to misunderstandings between officials who question the sanitary inspectors' method of measuring water quality and the methods of chlorinating the water.

The Health Department has several preventive medical programmes, such as the Reproductive and Child Health Programme, the National Vector-Borne Disease Control Programme, the Revised National Tuberculosis Control Programme, and the AIDS Control Society. In addition, it runs several awareness campaigns to educate the people to avoid water- and vector-borne diseases, offers drugs and distributes oral rehydration solutions and mosquito coils and nets. All these programmes are implemented by an army of multi-purpose workers (MPWs) and link workers, who form the critical connection between the urban poor and the health infrastructure. In addition, they are supported by non-governmental organizations. The MPWs perform multiple tasks, often unrecognized and inadequately compensated for their services. Each MPW (with four to five link workers) caters to the need of about 12,000 people, offering antenatal care for pregnant women, immunization for children and mothers, nutrition awareness for expectant and nursing mothers, care for new-born babies and encouragement for couples about family

planning; they also provide treatment to tuberculosis patients. Adding to these jobs, they form part of the active monitoring of the health status of the communities.

With urbanizing economies, rapidly growing population, poor water infrastructure, poor urban planning and marked inequalities, the urban authorities have been unable to build basic infrastructure to meet the growing demand. There is high risk of disease transmission in large urban regions due to increased rates of contact and mobility of people (Alirol, Getaz, Chappuis, & Loutan, 2011), making it complex to secure the public health of cities.

Conclusion

Diseases are rapidly urbanizing in this part of the world. The contested institutions integrate to allow the breeding of water- and vector-borne diseases in rapidly urbanizing societies such as Ahmedabad. Though Ahmedabad claims to have good coverage of drinking water and sanitation, this has not been successful in reducing the threat from water- and vector-borne diseases. To make it worse, these diseases are continually spreading, crossing the boundaries of economic divide, enveloping the urban region as a whole. The continuation of the colonial legacy of segmented planning and inadequate land-tenure arrangements in post-independence India is exploited by contemporary actors (international agencies, politicians, private companies, citizens and government bureaucrats) using public goods to benefit private interest (Chaplin, 2011). These, coupled with neo-liberal reforms, have reduced the role of the state to mere crisis-driven interventions that are either technocentric or overweighted with social solutions to address growing health insecurities. The paper highlights the complex structural problems associated with the growing urban water and health crisis. Addressing such complex problems requires synergizing sector-wide interventions with a stronger role from the state to address the structural issues. While the analysis presented in the paper is indicative, it will require more explorative studies to examine the socio-economic, hygiene, behaviour and health-care-seeking practices at the local level for a comprehensive understanding of the role of institutions in protecting urban health.

While urban political ecology highlights a plethora of actors, growing urban inequality and power relations that shape urban space, it tells little about the microsphere of everyday practice of water management and its political formation (Anand, 2011). There are a number of institutional arrangements that provide stimulus or potential for leverage points to foster integration. Such forms of integration do not have any specific tangible form, but, at any given time, are only realized through linkages between pre-existing activities across nodes; they act and interact through actors (Morrison, 2004, 2006). Institutional integration takes place in diverse arenas and at various levels in the social sphere (Dorcey, 1986). Understanding the microsphere of negotiations from an institutional perspective will identify the specific role of institutions in shaping water infrastructure and human health.

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Note

1. The exchange rate of INR 66 = USD 1 (as of 5 September 2013) is used throughout this paper.

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